REMARKS

Reconsideration of this application in light of the following remarks is respectfully requested.

The Cancellation of Claims 31-35

The Examiner has requested that non-elected claims 31-35, which were withdrawn from consideration following an election by applicants' attorney, be cancelled at this time. This request is acceded to subject to applicants' attorney's understanding that this is being done without disclaimer and without any prejudice to applicants' right to file a divisional application embodying these cancelled claims.

The Rejection of Claims 1-30

Claims 1-30 have been rejected under 35 U.S.C. § 103 (a) as obvious over either United States Patent No 6,077,432 of Coppola, et al ("Coppola") or United States Patent No 6,066,357 of Venkatesh, et al ("Venkatesh") in view of the article by Gingras, et al, appearing at J. Envion. Monit., (2002) 2: 96-101, (" Gingras") which is sometimes referred to as "Gingrase" in the Office Action under reply. This rejection is respectfully traversed.

Before discussing the rejection in detail, it is in order to review the present invention and the general state of the art in the area to which it relates.

The present invention is in the field of ion exchange processes for water treatment. Such processes have a water treatment step and either a spent resin disposal step or a spent resin regeneration step. The present invention concerns a new method for regenerating ion exchange resins which have been used to remove perchlorate contamination from water supplies.

There are certain characteristics of perchlorate ion and of perchlorate ion-contaminated water streams that make ion exchange particularly well-suited to perchlorate ion removal. These characteristics include:

1. Perchlorate ion, as a chemical entity, is recognized as being dangerous and detrimental to health at very low levels. Thus the levels of perchlorate contamination in water streams which call for remediation, and the levels to which perchlorate contamination must be reduced, are very low – in the parts per billion range and below. Ion exchange can meet these requirements.

2. Many water treatment ion exchange resins have very high affinity for perchlorate and bind perchlorate extremely tightly. This means that the equilibrium ratio of the amount of unbound perchlorate ion over the amount of perchlorate ion bound (absorbed) to the ion exchange resin in a typical ion exchange water treatment setting is pushed far into the direction of absorption. This means that at the actionable part-per-billion levels virtually all of the perchlorate can be taken up by the resin.

These characteristics which make ion exchange resins so good at taking up perchlorate during the water treatment stage of the process make the resins really bad at giving up their perchlorate load when called upon to do so during a regeneration stage. The classic process for loaded ion exchange resin regeneration, known to water softener users the world over, involves contacting the ion-loaded resin with a sodium chloride brine. This regeneration counts on the concentration of chloride ions to be high enough to shift the equilibrium in the direction of chloride ions displacing bound ion contaminants off of the resin. In the case of perchlorate, applicants and others (including the authors and patentees of the art cited in the Office Action under reply) have observed that the ion exchange resin's affinity for perchlorate is so strong that a very high salt concentration (generally 6-7 % or greater NaCl) is needed to achieve acceptable levels of regeneration. That, in and of itself, is not necessarily a particularly bad thing but, as will be revealed shortly, is really a problem in the context of the present invention.

The second characteristic of classic brine regeneration which poses a problem peculiar to perchlorate regeneration is that the perchlorate is released from the resin as perchlorate *per se*. This gives rise to a used, concentrated brine solution containing not parts per billion of perchlorate but rather many parts per million of perchlorate. In view of the extremely low action levels for perchlorate, this high-perchlorate-content brine can not be simply discarded down the

drain, as in the case of, say, water softener brine effluent, but rather must be treated as a toxic material.

The present invention provides a regeneration process by which the perchlorate load on a perchlorate-loaded used ion-exchange resin can be removed and eliminated. As set forth in independent claims 1 and 14, the present invention involves "...directly contacting the perchlorate-loaded ion exchange resin with a perchlorate-destroying microorganism fluid product under conditions leading to conversion of perchlorate load on the resin to nonperchlorate reaction products and generation of treated ion exchange resin having reduced perchlorate load relative to the perchlorate-loaded ion exchange resin."

With regard to the present invention as just described and its use of microorganisms to convert perchlorate to nonperchlorate reaction products, it was understood by those working in the field of perchlorate remediation that microorganisms existed which were capable of breaking down perchlorate to nonperchlorate products. It was also understood, however, that the high salt levels needed to desorb perchlorate from ion exchange resins were damaging to these microorganisms and their ability to efficiently bioremediate perchlorate.

With these thoughts in mind, let's review what the art cited in this rejection has to say relative to the process now being claimed in this application.

Primary references Coppola and Venkatesh are cited as teaching that "It was known to remove perchlorate from perchlorate-contaminated water by exchanging the perchlorate onto an ion exchange resin." This is certainly a fair statement. Venkatesh teaches this. Even though Coppola is primarily directed to the removal of perchlorate from perchlorate-contaminated waste water by feeding the contaminated water into at least one micro-reactor containing a mixed bacterial culture capable of reducing perchlorate, nitrate, hydrolysates and other energetic products, at column 6, lines 10-11 Coppola does note that the contaminated wastewater that it treats may be concentrated using an ion exchange process. For that matter, the first few lines of the secondary reference, Gingras, describe the use of ion exchange to remove perchlorate from perchlorate-contaminated water.

The Office Action then notes "It was further known to remove the perchlorate from the perchlorate-loaded ion exchange resin with a resin regenerant." Also a fair statement but one that must be qualified by noting that the regenerant solutions being described in these references are all salt brines. It should also be noted that all three of the references show that these brines have high salt contents. (see Venkatesh Figure 1 where a 7% NaCl brine effluent from the regenerated resin is noted; see Coppola's Example 3 where it was noted that the brine was too concentrated in salt to process further and had to be diluted; see Gingris, throughout the article). Please note, however, and this is very important, this teaching that a brine regenerant solution can be used to remove perchlorate from perchlorate-loaded ion exchange resin is NOT what is now being claimed. This use of a brine solution (and particularly the strong brines which perchlorate removal mandates) to regenerate a perchlorate-loaded ion exchange resin IS PRECISELY WHAT THE PRESENT INVENTION AVOIDS.

The Office Action then recites "It was known to decontaminate the spent regenerant stream of perchlorate using bacteria." This is again an accurate statement of what each of the three cited references teach, when qualified by the fact that the regenerant streams described in these references are perchlorate-laden strong brine solutions. Also again, this is NOT what is being claimed and IS IN FACT PRECISELY WHAT THE PRESENT INVENTION AVOIDS.

The Office Action then concludes "It would have been obvious to have fed a regenerant stream containing perchlorate-decontaminating bacteria directly to the perchlorate-loaded ion exchange resin as suggested by the Gingris printed publication." There are three problems with this conclusion. First, somehow the two step regeneration process of the three cited references – Step 1, concentrated brine displaces perchlorate off of the perchlorate-loaded resin and Step 2, the perchorate loaded brine is contacted with perchlorate-digesting microorganisms - has been magically converted to a single step process. Second, the regenerant stream has now been magically transformed from the strong brine solutions taught by each of the three cited references (which brine solutions both Gingris and Coppola point out are toxic to perchlorate-digesting bacteria) into a stream containing such bacteria. Third, it is not seen that Gingris suggests

making this substitution of a solid perchlorate-loaded resin for the perchlorate-loaded regenerant brine solution as the material being treated by the bacterila stream, as the rejection implies.

Reviewing Gingris carefully, one sees the following:

That the title describes bacterial treatment of "ion exchange resin REGENERANT SOLUTIONS" (emphasis added);

That the abstract describes bacterial treatment of saline regenerant solutions and goes on to point out that the salt content of these solutions interfered with the bacterial treatment and proposed further work to solve this by "isolation and./or acclimation of microorganisms that are able to biodegrade perchlorate under these stressful conditions;"

That the "Introduction" section of the Gingras paper teaches that there are two ways to deal with perchlorate-loaded ion exchange resins – 1. incineration or other direct disposal and 2. regeneration using a saline regenerant solution;

That the paper next describes "Potential composition of "IX REGENERANT SOLUTIONS" (again emphasis added) and describes these solutions as "Two potential regenerants for perchlorate-laden resins are either salts or caustic solutions; sodium chloride (NaCl) , ammonium hydroxide NH4OH) and sodium hydroxide (NaOH) have been used.";

That the "Results and discussion" section of the paper describes the composition of the ion exchange regenerant solutions which are loaded with desorbed perchlorate and which are are treated with bacteria as having high salt contents and further points out that the high salt contents of these regenerant solutions interfere with the ability of the bacteria to biodegrade the perchlorate contents of these regenerant solutions; and finally

That the conclusion reached by Gingras is "In summary, the preliminary results show that the mixed BALI culture was not able to biodegrade perchlorate-contaminated IX waste at acceptable rates. Further research will focus on acclimating and/or isolating microbial cultures that are salt tolerant…."

It is respectfully submitted that, considering these passages either individually or in combination with one another, one must conclude that the Gingras reference does not suggest treating a perchlorate-loaded resin with a regenerant solution containing perchlorate-decontaminating bacteria as the Office Action states. Gingris's focus is on pointing out the problems of perchlorate biodegradation in high salt regrenerant solutions. Its suggested solution is to come up with bacteria that can function in the high salt environment. The Gingras reference alone or in combination with the other references employed in this rejection does not suggest the radial departure from accepted practice which the present claims recite. Accordingly, it is respectfully requested that this rejection be reconsidered and withdrawn.

This obviousness rejection is the sole matter outstanding in this application. The other issues raised in the Office Action, such as the removal of nonelected claims, have been complied with. Thus this application is believed to be in condition for immediate allowance. Such action is earnestly solicited.

The Commissioner is hereby authorized to charge any fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 50-0872. Should no proper payment be enclosed herewith, as by the credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-0872.

Respectfully submitted,

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By ______________________

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